REMARKS

This application has been reviewed in light of the Office Action dated November 16, 2005. In view of the following remarks, favorable reconsideration and withdrawal of the rejections set forth in the Office Action are respectfully requested.

Claims 73-75 and 77-85 are pending. Claims 73, 83 and 84 are in independent form.

Claims 73, 74, 77-81 and 83-85 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Nos. 5,500,988 (*Moynihan et al.*) and 5,719,417 (*Roeder et al.*), and the article entitled "Growth and Characterization of . . . Single Crystal Piezoelectrics" (*Farrey et al.*). Claim 75 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Moynihan et al.*, *Roeder et al.*, *Farrey et al.* and further in view of European Patent Application Publication No. 0 930 165 (*EP '165*). Claim 82 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Moynihan et al.*, *Roeder et al.*, *Farrey et al.* and further in view of U.S. Patent No. 5,453,262 (*Dawson et al.*). Applicants respectfully traverse these rejections.

Independent Claim 73 recites, *inter alia*, a step of forming by a vapor method on a supporting substrate a first layer having a perovskite structure, a temperature at a time of formation of the first layer being at least 500°C during the vapor method, and a step of subsequently cooling from the formation temperature at least to 450°C with a cooling speed of at least 30°C/minute. Each of independent Claims 83 and 84 includes similar recitations.

None of the cited documents is understood to teach or suggest at least the step of "subsequently cooling from the formation temperature at least to 450°C with a cooling speed of at least 30°C/minute," as recited in the claimed combination.

Moynihan et al. teaches applying a series of PZT layers 3 to an electroded substrate 10 by a sol gel process, then annealing by heating to 600° C to 800° C, and then cooling to room temperature in about 30 seconds. See col. 3, lines 19-39.

According to *Moynihan et al.*, after a PZT layer is formed, it is fired to drive off organic materials, then annealed by heating to 600° C to 800° C, and then cooled. Thus, according to *Moynihan et al.*, the PZT layer is cooled from an annealing temperature, not from a formation temperature. Nothing in *Moynihan et al.* is understood to teach or suggest a step of "subsequently cooling from the formation temperature at least to 450°C with a cooling speed of at least 30°C/minute," as recited in the claimed combination.

Roeder et al. teaches depositing a layer of PLT and then a layer of PZT, using a vapor method, the process being carried out at temperatures between 525°-550° C. See, e.g., col. 7, lines 12-36. However, as is understood to be conceded by the Office Action, nothing in *Roeder et al.* would teach or suggest a step of "subsequently cooling from the formation temperature at least to 450°C with a cooling speed of at least 30°C/minute," as recited in the claimed combination.

Thus, neither *Moynihan et al.* nor *Roeder et al.* contains all of the elements of any of the independent claims. For at least this reason, those claims are believed allowable over the cited art. (While *Farrey et al.* was cited in the rejection of the independent claims, it is noted that that reference was not in fact applied against those claims.)

Furthermore, Applicants submit that the proposed combination of *Moynihan et al.* and *Roeder et al.* is not proper.

First, Applicants submit that the Office Action has not provided a valid motivation for combining *Moynihan et al.* and *Roeder et al.*

Moynihan et al.'s invention is designed to overcome specific problems in the prior art: (i) "the tendency of the preferred perovskite form of PZT to nucleate in a nonuniform manner at the film surfaces or to be pre-empted by nucleation and growth of a non-piezoelectric "pyrochlore" phase," resulting in "variations in the piezoelectric properties in the regions adjacent to the electrodes," and (ii) "the processing temperature required to initiate nucleation in the region adjacent to an electrode is highly dependent upon the choice of the electrode material and also tends to be higher than a temperature which is desirable to minimize loss and migration of lead from the PZT film" (col. 1, lines 42-54).

Moynihan et al.'s invention is understood to overcome these problems in the prior art, most essentially, by the specific manner of creating the PZT film 18, as set out at col. 3, line 16 - col. 4, line 13. PZT film 18 is created by depositing, annealing and cooling multiple PZT layers 3. The deposition, annealing and cooling procedures are carried out under specified conditions, and the PZT material of the layers 3 is to have certain specified properties. For example, the deposition is performed by a sol gel process. The layers 3 are preferably no more than 1 μm thick, and desirably about 0.5 μm thick, and are seeded with perovskite PZT seed particles whose size is small relative to the layer thickness, with a substantially uniform size distribution, and preferably a low concentration (e.g., about 0.1 μm in size and 1% concentration). If the thickness of the resulting PZT film 18 is to be greater

than a few microns, the film is preferably prepared by depositing it in several layers (e.g., eight 0.5 μm-thick layers). The resulting film is to have a thickness of about 1-25 μm, and most preferably about 3-5 μm. By virtue of this manner of creating the PZT film 18, under these conditions and using PZT material having these properties, the PZT film 18 is formed with a small uniform grain structure, yielding good mechanical performance and avoiding cracking. It is understood that this manner of creating PZT film 18, under these conditions and using PZT material having these properties, overcomes the prior art problems pointed out by *Moynihan et al.* and achieves the intended purpose of *Moynihan et al.*'s invention.

The Office Action (page 4) cites control of the orientation of the layers of the piezoelectric element as the motivation for combining the teachings of *Roeder et al.* with thsoe of *Moynihan et al.* (Applicants wish to clarify that the cited portion of *Roeder et al.* refers to control of the crystal orientation with which the PZT material is formed, not control of the orientation of the layers of the piezoelectric element during operation of the piezoelectric element.)

The Office Action offers no reason why *Moynihan et al.*'s invention would require, or would benefit from, the crystal orientation control provided by *Roeder et al.* Rather, *Moynihan et al.*'s invention already includes many specific measures (as detailed above) that achieve the specific material properties of the PZT film necessary to carry out the purpose of *Moynihan et al.*'s invention. See M.P.E.P. 2143.01 I. ("The prior art must suggest the desirability of the claimed invention" (emphasis added)).

Second, Applicants submit that the proposed combination of *Moynihan et al.* and *Roeder et al.* would change the principle of operation of the prior art and would render the

prior art unsatisfactory to achieve its intended purpose, and that the two references teach away from each other.

Moynihan et al.'s process of forming the PZT film 18 (as set out at col. 3, line 16 - col. 4, line 13 and explained above), which overcomes the prior art problems identified by *Moynihan et al.* and achieves the intended purpose of *Moynihan et al.*'s invention, is understood to constitute the essence of *Moynihan et al.*'s invention. The Office Action's proposed combination would replace this essence of *Moynihan et al.*'s invention with *Roeder et al.*'s vapor deposition method. Applicants submit that such wholesale modification of *Moynihan et al.*'s invention would necessarily change the principle of operation of *Moynihan et al.*'s invention. M.P.E.P. 2143.01 VI. In addition, it is believed that, by eliminating this essence of *Moynihan et al.*'s invention, the Office Action's proposed combination would render *Moynihan et al.*'s invention unsatisfactory to achieve its intended purpose. M.P.E.P. 2143.01 V. For example, the sol gel method and other aspects of forming the PZT film 18 are understood to be important to achieving the desired properties of the PZT film 18; and the combination of *Roeder et al.*'s vapor deposition method with whatever aspects of *Moynihan et al.*'s invention were deemed to be left intact by the proposed combination is not believed to necessarily result in the formation of a PZT film 18 that has the properties achieved by *Moynihan et al.*'s invention unaltered.

In addition, *Moynihan et al.*'s invention is understood to teach away from *Roeder et al.*'s vapor deposition method. M.P.E.P. 2145 X.D. *Roeder et al.*'s vapor deposition method involves high temperatures. *Moynihan et al.*'s sol gel process is understood to involve low temperatures, and *Moynihan et al.*'s invention is specifically designed to

overcome problems in the prior art caused by too high temperatures, as explained above (see col. 1, lines 49-54).

Finally, Applicants wish to respond to the Examiner's discussion of "the cooling aspects of [*Roeder et al.*]" in the "Response to Arguments" (Office Action, at page 7). In the last Amendment (filed August 3, 2005), Applicants had noted that *Roeder et al.* identifies a problem in the prior art caused by cooling, that *Roeder et al.*'s invention is not understood to involve such cooling, and that the cooling provided by *Moynihan et al.*'s method may not be suitable for combination with *Roeder et al.*'s method.

In response to this argument, the Office Action (page 7) states "the layers of [*Roeder et al.*] are subsequently cooled at least to the extent of normal atmospheric conditions being that the device of [*Roeder et al.*] is not to operate at temperatures above 500 °C ."

As made clear by the pertinent portion of *Roeder et al.* (col. 2, line 6-31), which Applicants had cited in their argument, the cooling in question occurs during a manufacturing process (specifically, during the process of forming a PZT film). The fact cited by the Office Action that, after *Roeder et al.*'s apparatus is fully manufactured, it is designed to be operated at room temperature, is not understood to be relevant to Applicants' argument. According to the Office Action's line of reasoning, it would follow that every apparatus designed to be used at room temperature (e.g., any typical consumer product) is therefore able to withstand being subjected to room temperature at all times during manufacture. The Office Action is understood to fail to distinguish between manufacturing conditions and conditions of use after manufacture. Accordingly, Applicants respectfully submit that their argument still holds.

Since the combination of *Roeder et al.* with *Moynihan et al.* is not seen to be proper, the independent claims are believed allowable over the cited art for at least this reason as well.

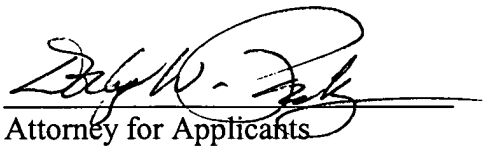
A review of the other art of record, including *Farrey et al.*, *EP '165* and *Dawson et al.*, has failed to reveal anything which, in Applicants' opinion, would remedy the deficiencies of the art discussed above, as references against the independent claims herein. Those claims are therefore believed patentable over the art of record.

The other claims in this application are each dependent from one or another of the independent claims discussed above and are therefore believed patentable for at least the same reasons. Since each dependent claim is also deemed to define an additional aspect of the invention, however, the individual reconsideration of the patentability of each on its own merits is respectfully requested.

In view of the foregoing remarks, Applicants respectfully request favorable reconsideration and early passage to issue of the present application.

Applicants' undersigned attorney may be reached in our Washington, D.C. Office by telephone at (202) 530-1010. All correspondence should continue to be directed to our below-listed address.

Respectfully submitted,



Attorney for Applicants
Douglas W. Pinsky
Registration No. 46,994

FITZPATRICK, CELLA, HARPER & SCINTO
30 Rockefeller Plaza
New York, New York 10112-3801
Facsimile: (212) 218-2200
AMZ/DWP

DC_MAIN 231266v1